REMARKS

Applicant requests favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

To place the application in better form, Applicant submits herewith a substitute specification, which includes a new abstract. For the Examiner's convenience, also provided is a marked-up copy of the original specification showing the portions thereof which are being changed. The substitute specification includes the same changes as are indicated in the marked-up copy. Applicant's undersigned attorney has reviewed the substitute specification and submits that the substitute specification contains no new matter.

Claims 9-16 are presented for consideration in lieu of claims 1-8, which have been canceled without prejudice or disclaimer. Claims 9 and 13-16 are independent. Support for these claims can be found in the original application, as filed. Therefore, no new matter has been added.

Applicant requests favorable reconsideration and withdrawal of the rejections set forth in the above-noted Office Action.

Claims 1-8 were rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. patent application publication number 2002/0159040 to Hamatani et al. Claims 1-8 were also rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,809,797 to Baselmans et al. Applicant submits that the cited art, whether taken individually or in combination, does not teach or suggest many features of the present invention, as previously recited in these claims. Therefore, these rejections are respectfully traversed. Nevertheless, Applicant submits that

independent claims 9 and 13-16, for example, as presented, amplify the distinctions between the present invention and the cited art.

In one aspect of the present invention, independent claim 9 recites an exposure method for projecting, through a projection optical system, a predetermined pattern formed on a mask onto an object to be exposed. The exposure method includes the steps of dividing an effective light source area for illuminating the mask into plural point light sources, calculating a Zernike sensitivity coefficient that represents sensitivity of a change of image quality of the predetermined pattern to a change of a Zernike coefficient, when wave front aberration in the projection optical system is developed into a Zernike polynomial for all divided point light sources, determining an effective light source distribution based on a combination of Zernike sensitivity coefficient of all divided point light sources, and forming the effective light source distribution by intensity of each point light source.

In another aspect of the present invention, independent claim 13 recites an exposure apparatus including a projection optical system for projecting a predetermined pattern formed on a mask onto an object to be exposed, an illumination optical system for varying an effective light source distribution for illuminating the mask, and a controller for forming the effective light source shape based on a combination of a Zernike sensitivity coefficient that represents sensitivity of a change of image quality of the predetermined pattern to a change of a Zernike coefficient, when wave front aberration in the projection optical system is developed into a Zernike polynomial for plural point light sources that divide an effective light source area for illuminating the mask by intensity of each point light source.

In a further aspect of the present invention, independent claim 14 recites a database suitable for an exposure method for projecting, through a projection optical system, a predetermined pattern formed on a mask onto an object to be exposed. The database indicates a combination of a Zernike sensitivity coefficient that represents sensitivity of a change of image quality of the predetermined pattern to a change of a Zernike coefficient, when wave front aberration in the projection optical system is developed into a Zernike polynomial for plural point light sources that divide an effective light source area for illuminating the mask by intensity of each point light source.

In still another aspect of the present invention, independent claim 15 recites a program that enables a computer to execute an exposure method for projecting, through a projection optical system, a predetermined pattern formed on a mask onto an object to be exposed. The exposure method includes the steps of dividing an effective light source area for illuminating the mask into plural point light sources, calculating a Zernike sensitivity coefficient that represents sensitivity of a change of image quality of the predetermined pattern to a change of a Zernike coefficient, when wave front aberration in the projection optical system is developed into a Zernike polynomial for all divided point light sources, determining an effective light source distribution based on a combination of Zernike sensitivity coefficient of all divided point light sources, and forming the effective light source distribution by intensity of each point light source.

In yet a further aspect of the present invention, independent claim 16 recites a device fabrication method including the steps of exposing an object using an exposure apparatus, and

performing a predetermined process for the object exposed. The exposure apparatus includes (i) a projection optical system for projecting a predetermined pattern formed on a mask onto an object to be exposed, (ii) an illumination optical system for varying an effective light source distribution for illuminating the mask, and (iii) a controller for forming the effective light source shape based on a combination of a Zernike sensitivity coefficient that represents sensitivity of a change of image quality of the predetermined pattern to a change of a Zernike coefficient, when wave front aberration in the projection optical system is developed into a Zernike polynomial for plural point light sources that divide an effective light source area for illuminating the mask by intensity of each point light source.

By such an arrangement, the present invention provides the ability to accurately and effectively optimize an effective light source shape. Applicant submits that the cited art does not teach or suggest such features of the present invention, as recited in independent claims 9 and 13-16.

The Hamatani et al. publication relates to a computer system that includes a first computer to which target information, which an optical apparatus is to achieve, is inputted, and a second computer that determines the specification of a projection optical system based on the target information received from the first computer via a communication path using a wave-front aberration amount, which the projection optical system is to satisfy, as a standard. In more detail, this publication discusses image quality improvement using a Zernike sensitivity coefficient for improving an effective light source shape.

The Baselmans et al. patent relates to a device manufacturing method in which aberration of a projection system of a lithographic projection apparatus is obtained in terms of Zernike expansion. The field distribution of displacement error and focal point distortion of the projected image are calculated on the basis of the Zernike aberration and sensitivity coefficients, which quantify the relationship between the Zernike aberration components and the error in the image. A calculation is then performed to determine the compensation to apply to the apparatus in order to minimize the error in the image. Thus, this patent discusses, in general, a lithographic apparatus that improves image quality or aberration in a projection optical system using the Zernike sensitivity coefficient.

Applicant submits, however, that neither the Hamatani et al. publication nor the Baselmans et al. patent teaches or suggests salient features of Applicant's present invention, as recited in independent claims 9 and 13-16. Notably, those citations are silent with respect to the particular steps to optimize the effective light source shape, in the manner of the present invention recited in those independent claims. Accordingly, neither citation should be read to anticipate Applicant's invention, as recited in those claims.

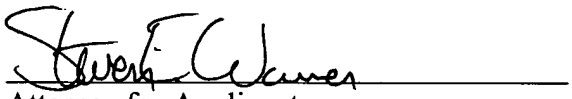
For the foregoing reasons, Applicant submits that the present invention, as recited in independent claims 9 and 13-16, is patentably defined over the cited art, whether that art is taken individually or in combination.

Dependent claims 10-12 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in independent claim 9. Further individual consideration of these dependent claims is requested.

Applicant further submits that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010 All correspondence should continue to be directed to our address given below.

Respectfully submitted,



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